

Urban Area Polycyclic Aromatic Hydrocarbons Study Tiered Approach to Corrective Action Objectives

Two background studies were recently completed investigating certain polycyclic aromatic hydrocarbon (PAHs) concentration levels in urban areas. One study was conducted within the limits of the City of Chicago and the other in urbanized areas across Illinois outside of Chicago. The City of Chicago study was conducted in consultation with the Illinois EPA. The Electric Power Research Institute (EPRI), in consultation with Illinois EPA, conducted the other study. The purpose of these studies was to determine background concentrations for some common PAHs in urban areas.

Where do PAHs come from?

PAHs come from a variety of sources; the majority of these sources are from the combustion or burning of fuels. Generally, any burning of an organic material such as coal, oil or wood will generate PAHs, and the existence of these chemicals is common throughout our society. Planes, automobiles, coal heating, forest fires, and power generation have all greatly contributed to the existence of these chemicals.

Why are PAHs a concern?

PAHs are a concern because they have been shown to have both a toxic and carcinogenic response in humans. Exposure to large amounts of PAHs can be harmful to human health.

What are background concentrations?

Background concentrations are generally considered to be the level or amount of a chemical found in common areas not associated with a particular contaminant release. Parks, roadways, residential yards, non-industrialized properties, etc., are typical background areas.

The definition from Tiered Approach to Corrective Action Objectives (TACO) is:

“Area Background” means concentrations of regulated substances that are consistently present in the environment in the vicinity of a site that are the result of natural conditions or human activities, and not the result solely of releases at the site. [415 ILCS 5/58.2]

How is this background concentration utilized?

Illinois EPA has published regulations establishing a methodology for setting remediation objectives for a number of chemicals. These risk-based objectives establish safe concentrations for chemicals for various exposure pathways. These regulations are referred to as TACO.

Illinois EPA has reviewed the reports of background concentrations of PAHs submitted by the City of Chicago Department of the Environment titled (*“Polynuclear Aromatic Hydrocarbon Background Study, City of Chicago”*) and for the Electric Power Research

Institute (EPRI; *Final Report on Background PAHs in Surface Soil in Illinois*). Illinois EPA finds these reports to be appropriately conducted studies yielding scientifically valid data regarding the background levels of PAHs in Illinois urban surface soils. Illinois EPA believes the data for the carcinogenic PAHs could form the basis for amending the current risk-based TACO soil remediation objectives to account for background occurrence. Until such amendments are adopted, remedial applicants for sites where PAHs are a concern may utilize the data from the two reports in developing site-specific remediation objectives under TACO.

Such use must occur in an appropriately conservative manner until final amended TACO values are determined through the rulemaking process. Illinois EPA recommends that since the data sets for nearly all the individual PAHs in both studies were found to be lognormally distributed, the lognormal 95th percentiles of the data sets should be the values used for comparison purposes. The 95th percentiles calculated from the Chicago background study are to be used inside the Chicago city limits. The EPRI study determined background PAH concentrations for locations both within and outside of Metropolitan Statistical Areas (MSAs). The 95th percentiles calculated for the EPRI study are the comparison values used outside the Chicago city limits. Since all samples in both data sets were collected within urban areas having population densities of at least 1,000 people per square mile and a minimum population of at least 10,000, these comparison values should only be used for sites in areas with similar characteristics. (i.e., the background PAH data should not be used for rural communities, farm land, etc.). These comparison values could be used to support a Tier III impractical remediation determination (35 Illinois Administration Code 742.920) in accordance with the TACO regulations. These values are included in the following table:

Background Carcinogenic PAH 95th Percentile Concentrations (mg/kg)

PAH Name	Chicago	Within MSA	Outside of MSA
Benzo(a)anthracene	1.1	1.8	0.72
Benzo(b)fluoranthene	1.5	2.0	0.70
Benzo(k)fluoranthene	1.0	1.7	0.63
Benzo(a)pyrene	1.3	2.1	0.98
Chrysene	1.1	2.7	1.1
Dibenzo(a,h)anthracene	0.20	0.42	0.15
Indeno(1,2,3-c,d)pyrene	0.86	1.6	0.51

Metropolitan Statistical Area (MSA)--A Core Based Statistical Area associated with at least one urbanized area that has a population of at least 50,000. The Metropolitan Statistical Area comprises the central county or counties containing the core, plus adjacent outlying counties having a high degree of social and economic integration with the central county as measured through commuting.

This definition of MSA is available at <http://www.census.gov/population/www/estimates/aboutmetro.html>.

MSAs for Illinois are identified in 35 Illinois Administration Code 742. Appendix A Table G of TACO

Procedure: This background information can be used with TACO rules. Until such time as the Illinois Pollution Control Board incorporates this study as a rule, a site undergoing remediation and seeking a No Further Remediation letter in such programs as the Site Remediation Program or the Leaking Underground Storage Tank Program may use these data to establish site-specific remediation objectives (see Section 742.920). Persons wishing to use these background data in the application of TACO will need to reference the applicable report and need not resubmit the applicable report in its entirety. This reference will reduce the amount of paperwork in requesting the use of the data. Of course, all other information requirements from the individual programs are still necessary.

In addition, for sites outside of Chicago, it must be determined whether the remediation site is located in a urban area similar to the sampled areas (population densities of at least 1,000 people per square mile and a minimum population of at least 10,000) to justify the establishment of background concentrations in accordance with 35 Illinois Administration Code 742.415. This is required for both MSA and non-MSA areas.

Aluminum	9,500	9,200
Antimony	4.0	3.3
Arsenic	13.0	11.3
Barium	110`	122
Beryllium	0.59	0.56
Cadmium	0.6	0.50
Calcium	9,300	5,525
Chromium	16.2	13.0
Cobalt	8.9	8.9
Copper	19.6	12.0
Cyanide	0.51	0.50
Iron	15,900	15,000
Lead	36.0	20.9
Magnesium	4,820	2,700
Manganese	636	630
Mercury	0.06	0.05
Nickel	18.0	13.0
Potassium	1,268	1,100
Selenium	0.48	0.37
Silver	0.55	0.50
Sodium	130	130.0
Sulfate	85.5	110
Sulfide	3.1	2.9
Thallium	0.32	0.42
Vanadium	25.2	25.0
Zinc	95.0	60.2

BOARD NOTE: Counties within Metropolitan Statistical Areas: Boone, Champaign, Clinton, Cook, DuPage, Grundy, Henry, Jersey, Kane, Kankakee, Kendall, Lake, Macon, Madison, McHenry, McLean, Menard, Monroe, Peoria, Rock Island, Sangamon, St. Clair, Tazewell, Will, Winnebago and Woodford.

(Source: Amended at 31 Ill. Reg. 4063, effective February 23, 2007)

Section 742.APPENDIX A: General

Section 742.TABLE H Concentrations of Polynuclear Aromatic Hydrocarbon Chemicals in Background Soils

Chemical Name	Chicago ^a mg/kg	Metropolitan Areas ^b (mg/kg)	Non-Metropolitan Areas ^c (mg/kg)
2-Methylnaphthalene	-----	0.14	0.29
Acenaphthene	0.09	0.13	0.04

Acenaphthylene	0.03	0.07	0.04
Anthracene	0.25	0.40	0.14
Benzo(a)anthracene	1.1	1.8	0.72
Benzo(a)pyrene	1.3	2.1	0.98
Benzo(b)fluoranthene	1.5	2.1	0.70
Benzo(g,h,i)perylene	0.68	1.7	0.84
Benzo(k)fluoranthene	0.99	1.7	0.63
Chrysene	1.2	2.7	1.1
Dibenzo(a,h)anthracene	0.20	0.42	0.15
Fluoranthene	2.7	4.1	1.8
Fluorene	0.10	0.18	0.04
Indeno(1,2,3-c,d)pyrene	0.86	1.6	0.51
Naphthalene	0.04	0.20	0.17
Phenanthrene	1.3	2.5	0.99
Pyrene	1.9	3.0	1.2
^a Chicago means within the corporate limits of the City of Chicago. ^b Metropolitan area means a populated area, as defined in Section 742.200, (other than the City of Chicago) that is located within any county in a Metropolitan Statistical Area listed in Appendix A, Table G, footnote a. ^c Non-Metropolitan area means a populated area, as defined in Section 742.200, that is not located within any county in a Metropolitan Statistical Area listed in Appendix A, Table G, footnote a.			

(Source: Appendix A, Table H renumbered to Appendix A, Table I and new Appendix A, Table H Added at 31 Ill. Reg. 4063, effective February 23, 2007)

Section 742.APPENDIX A General

Section 742.TABLE I Chemicals Whose Tier 1 Class I Groundwater Remediation Objective Exceeds the 1 in 1,000,000 Cancer Risk Concentration